Exploiting bacterial peptide display technology to engineer biomaterials for neural stem cell culture.

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Public Summary:

Scientific Abstract:
Stem cells are often cultured on substrates that present extracellular matrix (ECM) proteins; however, the heterogeneous and poorly defined nature of ECM proteins presents challenges both for basic biological investigation of cell-matrix investigations and translational applications of stem cells. Therefore, fully synthetic, defined materials conjugated with bioactive ligands, such as adhesive peptides, are preferable for stem cell biology and engineering. However, identifying novel ligands that engage cellular receptors can be challenging, and we have thus developed a high throughput approach to identify new adhesive ligands. We selected an unbiased bacterial peptide display library for the ability to bind adult neural stem cells (NSCs), and 44 bacterial clones expressing peptides were identified and found to bind to NSCs with high avidity. Of these clones, four contained RGD motifs commonly found in integrin binding domains, and three exhibited homology to ECM proteins. Three peptide clones were chosen for further analysis, and their synthetic analogs were adsorbed on tissue culture polystyrene (TCPS) or grafted onto an interpenetrating polymer network (IPN) for cell culture. These three peptides were found to support neural stem cell self-renewal in defined medium as well as multi-lineage differentiation. Therefore, bacterial peptide display offers unique advantages to isolate bioactive peptides from large, unbiased libraries for applications in biomaterials engineering.